OCS Report
MMS 99-0027

Investigation of
Rig Collapse Accident, Fatalities, and Injuries
Main Pass Block 153
Gulf of Mexico
Off the Louisiana Coast
July 17, 1998

MMS
U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Regional Office

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Investigation of Rig Collapse Accident, Fatalities, and Injuries Main Pass Block 153 Gulf of Mexico Off the Louisiana Coast July 17, 1998

Frank Pausina
Tommy Laurendine
Tom Perry
Daniel Knowlson

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Regional Office

New Orleans
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Contents

Investigation and Report

Authority

The partial collapse of a platform drilling rig that resulted in three fatalities and thirteen injuries during rigging-up operations occurred on Ocean Energy, Inc.'s (OEI) Platform B, Main Pass Block 153, Lease OCS-G 1967 in the Gulf of Mexico, offshore the State of Louisiana, on July 17, 1998, at approximately 1200 hours. Pursuant to Section 208, Subsections 22 (d), (e), and (f), of the Outer Continental Shelf (OCS) Lands Act, as amended in 1978, and the Department of the Interior Regulations 30 CFR Part 250, the Minerals Management Service (MMS) is required to investigate and prepare a public report of this accident. By memorandum dated August 14, 1998, the following MMS personnel were named to the investigative panel:

Frank Pausina	New Orleans, Louisiana (Chairman)
Tommy Laurendine	New Orleans, Louisiana
Tom Perry	New Orleans, Louisiana
Daniel Knowlson	Santa Maria, California

Procedures

On the afternoon of July 17, 1998, Inspectors Cynthia Thompson and Elbert Clemens of the MMS New Orleans District Office visited the scene of the accident, thereby initiating MMS's investigation of the incident.

On the morning of July 18, 1998, the accident scene was investigated by MMS personnel including panel members Tommy Laurendine and Tom Perry.

On July 23, 1998, a meeting attended by representatives of OEI, Nabors Offshore Drilling, and MMS, including panel members Tommy Laurendine and Tom Perry, was held at the MMS offices in New Orleans. At the meeting, the status and cleanup plans of the accident scene were discussed as were the drilling plans for the platform.

The panel conducted a formal hearing on August 27, 1998, at the MMS offices in New Orleans, Louisiana, during which the following individuals were questioned:

William Flores, OEI

John Mullican, Total Operating

Philip Wasterval, Nabors Offshore Drilling

Gerald Dartez, Nabors Offshore Drilling

The panel conducted a second hearing on October 2, 1998, during which the following individuals were questioned:

Jerry Shanklin, Nabors Offshore Drilling

Ernie White, Nabors Offshore Drilling

Sean Bailey, Nabors Offshore Drilling

Matt Hebert, Nabors Offshore Drilling

Lieutenant Rick Hawkins of the United States Coast Guard participated on the panel during the above-referenced hearings.

Throughout the investigation numerous conversations took place between panel members and representatives of OEI and Nabors Offshore Drilling for the purpose of obtaining for the panel information related to the investigation.

The panel members met at various times throughout the investigative effort and, after having considered all of the information, produced this report.

In March 1998, the panel chairman requested of Nabors Offshore Drilling's legal representative a copy of the investigative report of the accident that had been prepared by a consulting firm that had been contracted by Nabors to investigate the accident. The panel was informed that Nabors declined to submit the report on the basis that they considered the report to be privileged information. Because the panel considers the information currently in the case file to be sufficient for determining the causes of the accident and because any delay in concluding our report due to the time required to obtain the requested report through a compulsory legal process would therefore be unnecessary, the panel decided to conclude its investigation without benefit of obtaining the requested report.

Introduction

Background

Lease OCS-G 1967 covers approximately 5,000 acres and is located in Main Pass Block 153, Gulf of Mexico, off the Louisiana coast. *For lease location, see Attachment 1.* The lease was issued effective January 1, 1970. OEI and Shell Frontier Oil & Gas Inc. became co-owners of the lease in October 1997. OEI became the designated operator of the lease in February 1998. Platform B was installed in 1970.

Brief Description of Accident

On the morning of July 17, 1998, during the final stages of rigging-up operations, Nabors Rig 269's upper substructure was being skidded in preparation for the positioning and raising of the rig's derrick (mast). As the upper substructure was skidded to within a foot or two of its targeted position, the underlying substructures tilted and slid to the side to which the upper substructure had been skidded. As a result of that movement, the upper substructure, other drilling rig components, and two employees fell into the sea. One of the employees was never found and presumed a fatality; the other was rescued. Two other employees fell onto a barge and were fatally injured. Twelve other employees were injured.

Findings

Nabors Rig 269

Nabors drilling Rig 269 was originally a land-based rig that was modified for offshore use. The rig was first used offshore on Chevron's Platform C in South Pass Block 77. The rig was then modified again for use on OEI's Platform B in Main Pass Block 153. OEI's plans called for the rig to drill two side-tracks and four to five developmental wells. *For a schematic of the assembled substructure of Rig 269 at the time of the accident and prior to the skidding operation,* see *Attachment 2.*

The above-referenced modifications of the rig for use on Platform B consisted of the following:

1. The addition of the mud process deck and pump parts house to the lower substructure.
2. The lengthening of the intermediate substructure with associated strong back supports.
3. The addition of shimming beams, support beams, and false capping beams.
4. The use of a heavier upper substructure.

For a simplified drawing of the rig at the time of the accident and prior to the skidding operation indicating the modifications, see Attachment 3.

As can be seen from the schematic and drawing, the lower substructure extends beyond the supporting structures beneath it, namely the shimming beams, support beams, and false capping beams. Further, at the time of the accident, the only physical attachment between any of the substructures and underlying beams

existed between the false capping beams and support beams, which were welded together, and the intermediate and lower substructures, which were pinned.

Because the most usual deployment of platform rigs is parallel to the long axis of the platform, i.e., parallel to the platform's skidding beams, it is important to note that Rig 269 was deployed transversely on Platform B at the time of the accident, i.e., perpendicularly to the long axis of the platform and the platform's skidding beams.

Nabors Rig 270

Prior to the accident, Rig 269's sister rig, Nabors Rig 270, had been similarly deployed transversely on Pogo Producing Company's Platform A in Ship Shoal Block 331. The significance of that transverse deployment of Rig 270 will be discussed later in the report. *For a schematic of Rig 270's transverse deployment, see Attachment 4.* As can be seen from Attachment 4, the lower substructure rests on support beams that extend on one side to the end of the main part of the lower substructure, and it is to that side that the upper structure was skidded.

Accident

On July 17, 1998, at approximately 0900 hours, operators began skidding the upper substructure to the mud processing deck side of the platform in preparation for mast raising. The upper substructure was being skidded using four hydraulically driven rams. The hydraulics normally used to operate the crane winches were rerouted to the ram chambers and controlled by the

hydraulic manifold. The hydraulics were operated by the Nabors driller who, at the time of the accident, was positioned on the pipe rack. The driller was in communication by radio with the Nabor's toolpusher who was positioned, together with the Nabor's project drafting coordinator, on the mud processing deck extension of the intermediate substructure. The toolpusher was communicating to the driller via the radio as the skidding was in progress. The targeted final position of the upper substructure was approximately two feet from the edge of the extension of the intermediate substructure.

During or at the conclusion of a skid jacking stroke at approximately 1200 hours, and with the upper substructure approximately a foot from the targeted final position, the lower and intermediate substructure tilted downward to the side of the skidded upper substructure. This caused the intermediate substructure drop-in panel and the interior portion of the intermediate and lower substructures to rise. The entire substructure then began sliding to the side of the platform to which the upper substructure had been skidded. As a result of that movement, the upper substructure, other components of the rig, and two employees fell into the sea. One of these employees, the project drafting coordinator, was rescued; the other, the toolpusher, was never found. In addition, two contract hands were fatally injured when they fell from the pipe rack area to the materials barge. Twelve other employees were injured in the accident.

For drawings of the substructure positions in the initial stages of the accident and at the conclusion of the accident, see Attachments 5 and 6, respectively. For

photographs of the platform at the conclusion of the accident, see Attachments 7, 8, and 9.

It should be noted that, since the accident occurred near lunchtime, many of the rig personnel were in the galley. It should also be noted that skidding operations, while requiring a high degree of safety, do not require the same level of general safety and resultant area evacuation as mast raising. Therefore, the time of the accident can arguably be viewed as fortuitous with respect to the increased number of personnel who could have otherwise been exposed to the dangers associated with this accident.

Engineering Analyses/ Assumptions

Nabors contracted the engineering analyses for the deployment of Rig 269 on OEI's Main Pass Block 153 Platform B to two consulting firms. With respect to these analyses, the Nabors Project Engineer for this deployment stated that:

1. The mast-raising analysis consisted of the use of a STRUCAD computer model.
2. The purpose of the mast-raising analysis was to find structural inadequacies with respect to the load-bearing capacity of the rig support components, i.e., the intermediate and lower substructures and the shimming and support beams.
3. The analysis was not reviewed by Nabors with respect to any center of gravity problems, i.e., overturning moment problems. However, overturning moment problems can be detected in the analysis model results, albeit with more effort than for structural inadequacies.

4. The mast-raising analysis was done with the upper substructure in its final skidded position with the mast connected and elevated less than 45 degrees above horizontal.

5. There were no center of gravity calculations performed because of
   a) the results of the mast-raising analysis for the previously mentioned transverse deployment of Rig 270,
   b) the results of the center of gravity calculations for Rig 270, and
   c) the successful rigging-up of Rig 270.

6. The computer model used by the consulting firm assumed pinned connections at the top and bottom of the intermediate substructure drop-in panel.

7. The computer model also assumed water in the tanks located at the lower substructure level. However, the Project Engineer did not expect water to actually be in the tanks at the time of the skidding because he did not feel there was any stability or overturning problem associated with the operation.

8. After the mast-raising analysis was completed, the aforementioned pinned connections at the top of the drop-in panel were changed to seat connections by another consulting firm hired by Nabors for some structural design work. The calculations also assumed that the upper substructure and raised mast were located near the center of the drop-in panel, i. e., over a well slot. However, Nabors failed to notify the consultants responsible for the mast-raising analysis of the connection change. Furthermore, had such communication taken place, it would have been verbal.

9. The project manager stated that as a matter of course he does not check in detail the results of third-party calculations and analyses but rather "overviews" them, as was done in the case of Rig 269's deployment.

It should be noted that the computer model used by the consulting firm in the mast-raising analysis inherently assumes that all interfaces of the substructure are connected. However, at the time of the accident and as stated previously in this report, the only substructure interface connections consisted of welds between the support beams and the false capping beams and pins between the intermediate and lower substructures. Additionally, in contradiction to the assumptions of the model, the mud tanks at the intermediate substructure level were empty at the time of the accident.

In summary, the analyses performed for the deployment of Rig 269 were reviewed by both Nabors and OEI for the purpose of determining the structural strength of all substructure members and deck components for maximum vertical load conditions and not rig component overturning moment problems.

Management Policies/ Communications/ Delegation

The president of Nabors stated in the hearing that under normal operating procedures the ultimate responsibility for verifying that needed analyses are done and that the calculations of those analyses are correct rests with Nabors' Vice President of Engineering. However, for the deployment of Rig 269 that responsibility effectively rested with the Project Manager, who stated that he was not aware of any policy that called for a verification that the required

analyses are performed and that the calculations of those analyses are correct. While the Project Manager stated that he only overviews analyses and calculations, he stated that he was responsible for ensuring that the needed analyses for Rig 269's deployment were performed and that the calculations were correct. The Project Manager further stated that the ensurance of the correctness of analyses relied upon the hiring of competent consultants. Consistent with that reliance is the Project Manager's stated overviewing of analyses and calculations. Inconsistent with that reliance is the Project Manager's stated responsibilities with respect to ensuring that the needed analyses are performed and that the calculations are correct.

The Project Manager stated that decisions as to whether or not water was to be added to the mud tanks on the intermediate substructure level or whether or not to make any connections to the substructure interfaces prior to the skidding and mast-raising activities were left to whoever was in charge of the rig-up in the field on location. These field personnel are not engineers. The Project Manager did not expect the tanks to be filled with water at the time of the mast raising; he did, however, expect that vertical plates be welded to connect (a) the lower substructure to the shimming beams, and (b) the shimming beams to the support beams, as was done on Rig 270 transverse deployment.

Conclusions

Cause

During the skidding operation, the upper substructure reached the point where its center of gravity had moved sufficiently beyond the last support beam to the extent that the moment of the weight of the upper substructure acting through its center of gravity about the last support beam was greater than the summation of the countering moments of the weights of the intermediate and lower substructures and shimming beams about that same support beam. This imbalance caused the lower and intermediate substructures to rotate about the last support beam resulting in the lower and intermediate substructures sliding to the side of the platform to which the upper substructure was skidded. As a result of that movement, sufficient tilting occurred which caused the upper substructure, other rig components, and two employees to fall into the sea. Of those two employees, one was never found and is presumed a fatality, while the other was rescued. Two other employees fell from the other side of the platform to a materials barge and were fatally injured. Twelve other employees were injured, with varying degrees of severity, as a result of the rig's movement.

Contributing Causes

Physical

1. The absence of water in the mud tanks in the lower substructure, the absence of pin connections between the top of the drop-in panel and intermediate substructure, and the absence of connections between the lower substructure, shimming beams, and support beams contributed to the accident in that their presence in various combinations would have either (a) increased the magnitude of the above-referenced countering moments

around the farthermost support beam or (b) physically resisted the initial movement of the substructure.

2. Given the aforementioned absences of connections and water in the mud tanks, the extension of the false capping beam, shimming beams, and support beams to the original end of the lower substructure, i.e., that part of the lower substructure to which the mud process deck was added, would have both (a) increased the countering moments by lengthening the moment arms of the intermediate and lower substructures and shimming beams to the last support beam and (b) decreased the moment of the upper substructure by decreasing its moment arm to the last support beam. Therefore, the failure to provide such an extension is considered to be a contributing cause of the accident.

Analysis

1. Since the actual configuration and conditions of Rig 269 at the time of the accident differed from the mast-raising analysis model assumptions, the analysis could not therefore be expected to predict the type of catastrophic event that actually occurred. However, even if the actual configuration and conditions did agree with the analysis assumptions and the analysis did indicate a potential overturning moment problem, i.e., center of gravity problems, it is reasonable to conclude that overturning moment problems would not have been detected by Nabors given the following:

a) The analysis performed by the contractor and the review of the analysis findings by Nabors concentrated on maximum vertical load considerations and not overturning moment considerations.

b) Overturning moment problems are much more subtly detected in the analysis model output.

c) The Project Manager for Nabors performed an overview of the analysis only.

d) The Project Manager for Nabors did not review the analysis for overturning moment problems.

2. The analysis of the mast-raising did not include direct center of gravity calculations. A center of gravity calculation with the upper substructure skidded to its targeted position and the absence of water in the tanks would have more directly shown an overturning moment problem, i.e., the composite center of gravity of the substructure system lying beyond the outermost support beam. However, had the analysis assumed water in the tanks, no overturning moment problem would have been indicated because of the massive contribution of the water's weight to the countering moment's magnitude.

Assumptions Based on Rig 270

Because of the success of the skidding and mast raising on the similarly transversely deployed Rig 270, the vertical load analysis and center of gravity calculations performed for that deployment, and the load analysis for Rig 269, Nabors assumed that the skidding and mast-raising operations of Rig 269 were

safe to the degree that no center of gravity calculations were required. This assumption was made, however, despite the differences in the substructure configurations and supports for both rigs in their respective deployments, which are described earlier in this report. Had a center of gravity calculation been performed for Rig 269, with the proper assumption of no water being in the mud tanks, an overturning moment problem would have very likely been detected.

Management

1. A lack of a formalized procedure within Nabors by which the physical assumptions of any engineering analysis would be ensured to exist at the time of upper substructure skidding and mast raising contributed **more than any other factor** to the cause of the accident. Had the assumptions of water-filled tanks and pinned connections been implemented at the time of the skidding operations, the accident would not have occurred. However, the decisions to fill the mud tanks and make certain other substructure connections were instead left to the discretion of nonengineering field personnel.
2. The apparent lack of an official set of procedures within Nabors for determining when past experiences and analyses with similar operations are an appropriate substitute for a current engineering analyses resulted in a lack of center of gravity calculations for Rig 269. Even though a center of gravity calculation for 269 would not have shown an overturning moment problem given the incorrect assumption of water-filled tanks, such a calculation would have shown that the center of gravity of the upper

substructure was lying beyond the last support beam and therefore could reasonably be expected to have alerted the reviewer of the calculations to the importance of having the assumptions of the analyses agree with actual field conditions, especially the water-filled tanks. Even though the transverse deployments of Rigs 269 and 270 shared similarities, the differences between their respective substructure supports were too critical for such assumptions to have been made.

3. The apparent inconsistency between (a) the Project Manager's stated responsibility for ensuring that the needed analyses are performed and verifying the calculations are correct and (b) the overviewing nature of his calculation verification can be considered a contributing cause of the accident. The contributing aspect of the inconsistency lies in the arguable conclusion that increased attention by the Project Manager to the details of the calculations could have, as stated in No. 2 above, alerted the Project Manager to the importance of the agreement between analyses assumptions and actual field conditions.

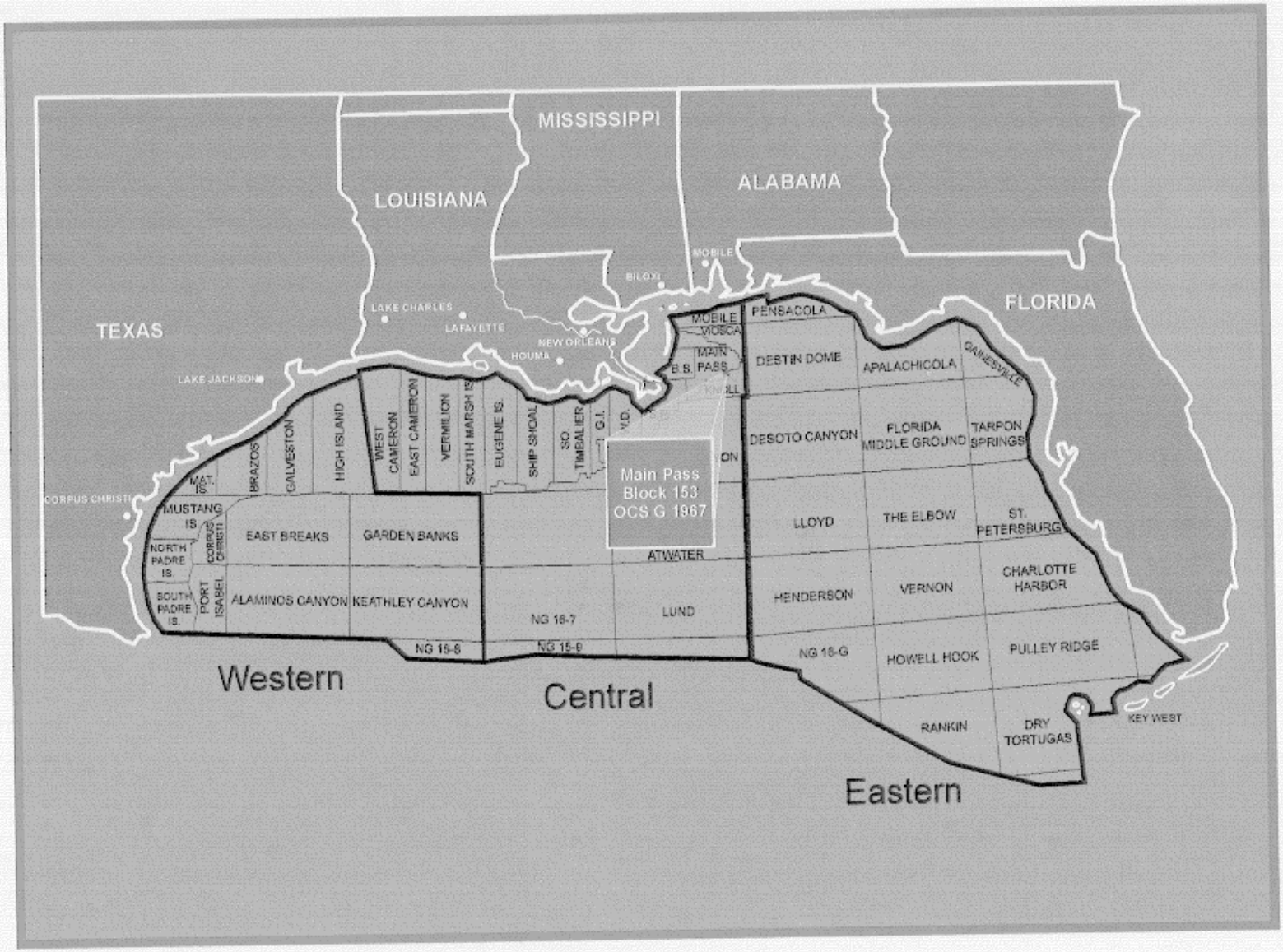
4. As the lease operator, OEI is responsible by Federal regulations for the safety of all activities occurring on their lease. OEI's involvement in the engineering analysis review was restricted to gross load considerations during drilling operations and their subsequent effect on the load-bearing members of their Platform B. While OEI should have requested that a center of gravity calculation be performed by Nabors given the uniqueness of the rig's deployment, it is not unreasonable that an operator rely upon a contractor's expertise and experience in the expectation of the proper

performance of those aspects of the contracted operation that are highly specialized, such as the installation of a drilling rig.

Recommendations

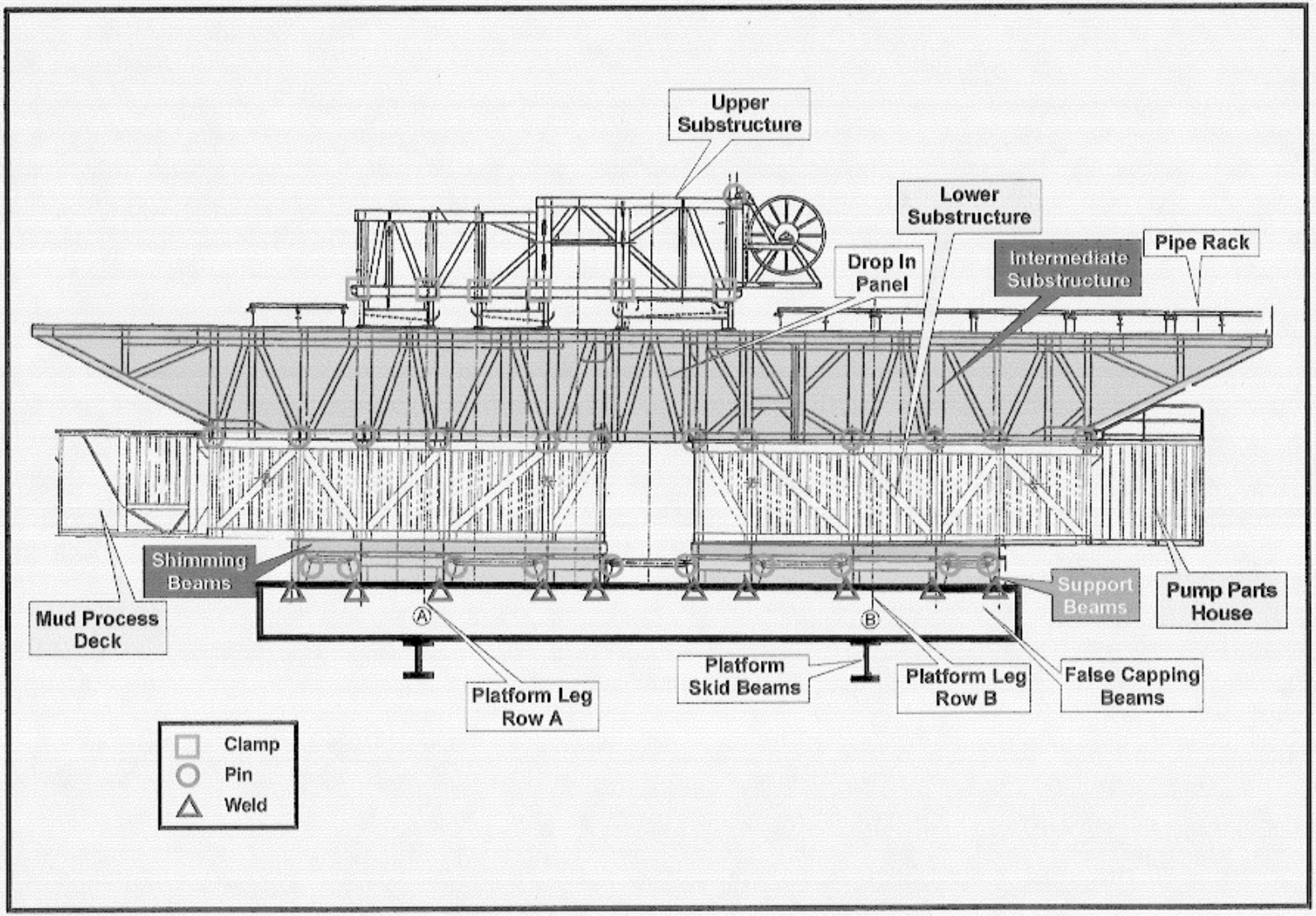
The MMS should issue a Safety Alert to all lessees and operators containing the following:

1. A brief description of the accident appearing in this report.
2. For those cases where a drilling rig is not using the platform's skidding beams in a traditional manner and also in which rig substructures are used with a platform/substructure support beam interface, it is recommended that:
    a) The drilling contractor develop an official written procedural guideline that details all engineering-related aspects of the installation of the rig,
    b) The operator be familiar with the procedural guideline and have on site during installation a representative to ensure compliance with the guideline, and
    c) The operator and contractor in conjunction hire an independent consultant to verify the correctness and sufficiency of all engineering analyses related to the installation of the drilling rig.



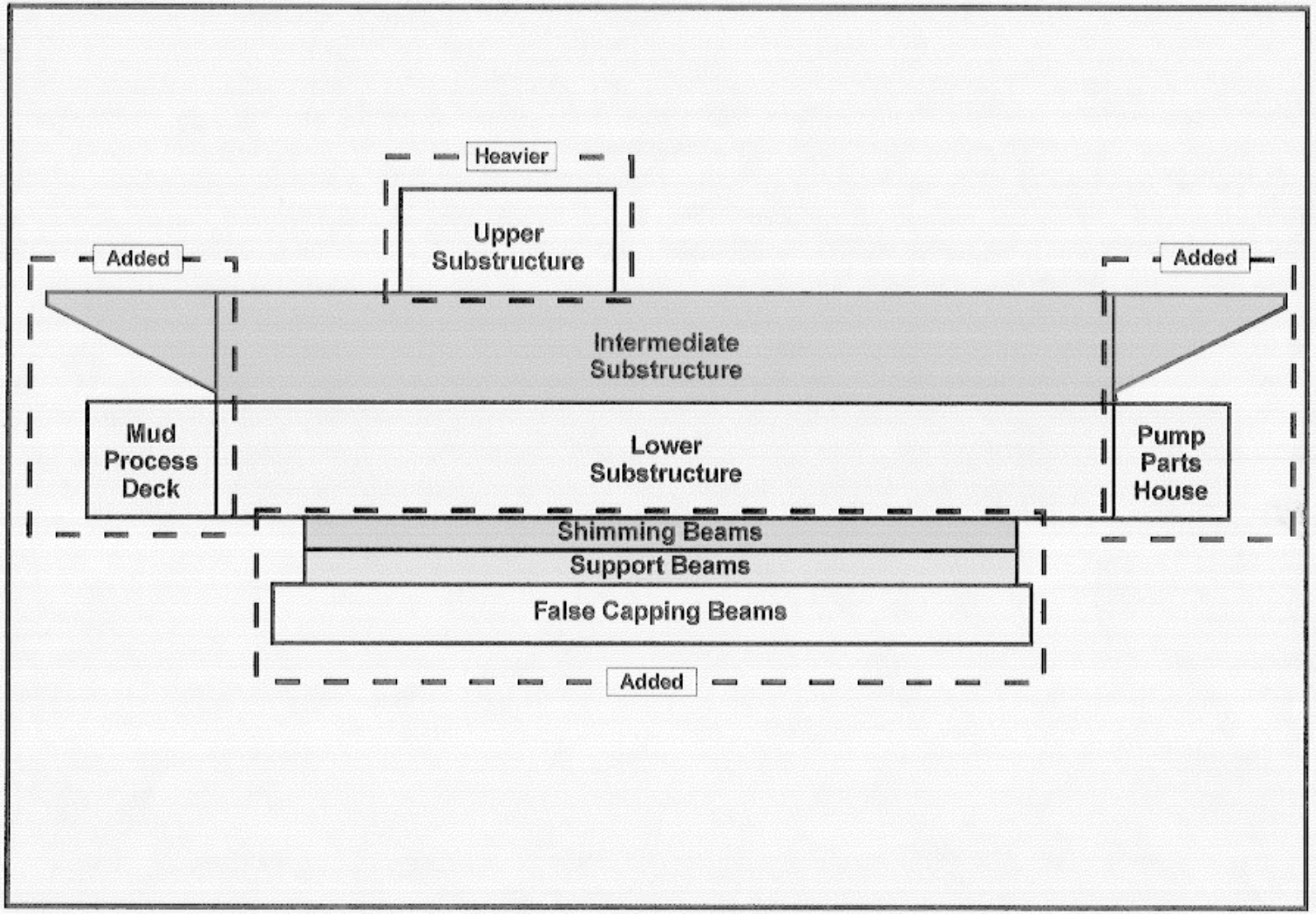
Location of Lease OCS G 1967, Main Pass Block 153.

Attachment 1



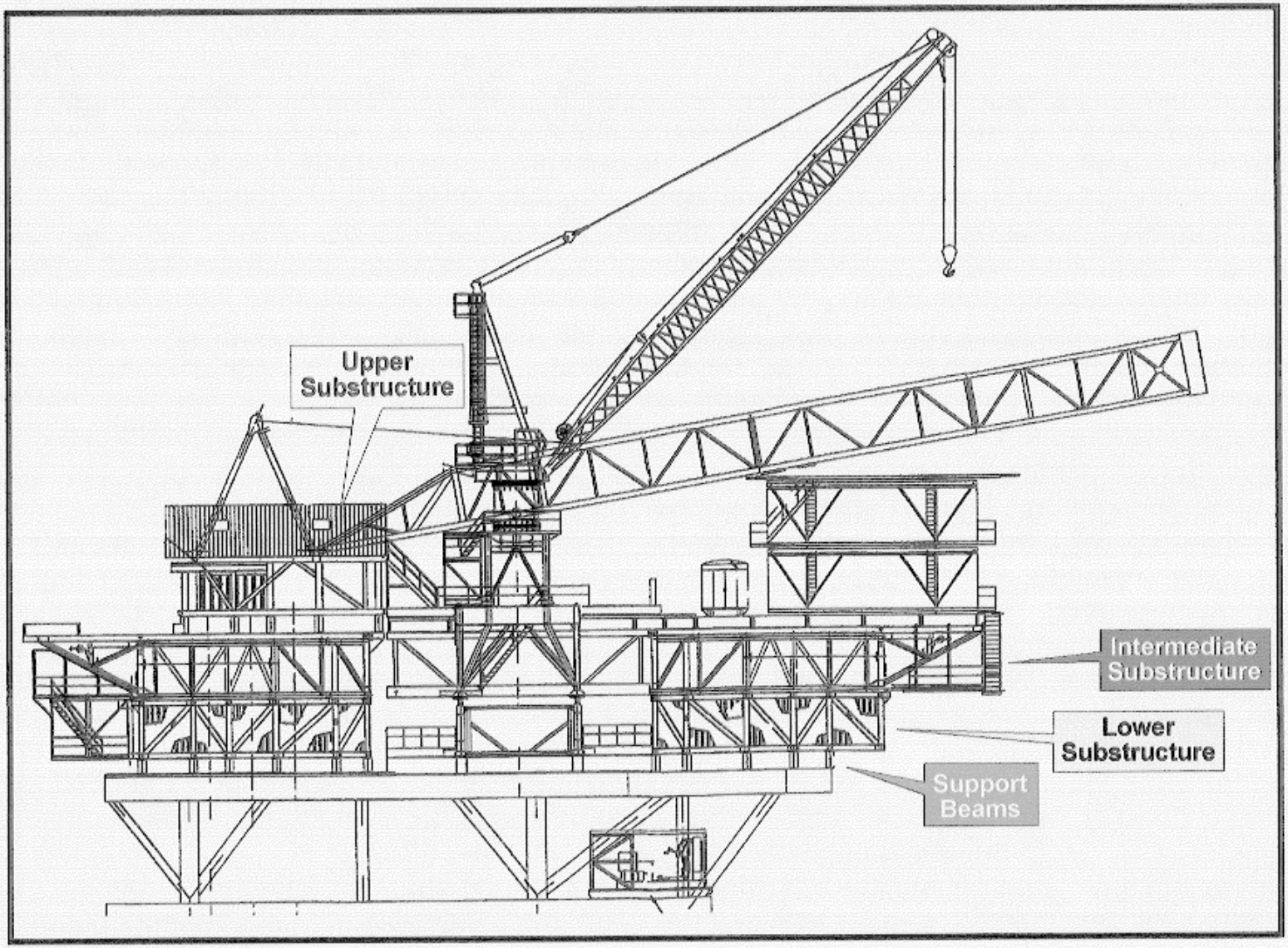
Schematic of Assembled Substructure of Rig 269 Prior to Skidding Operation

Attachment 2



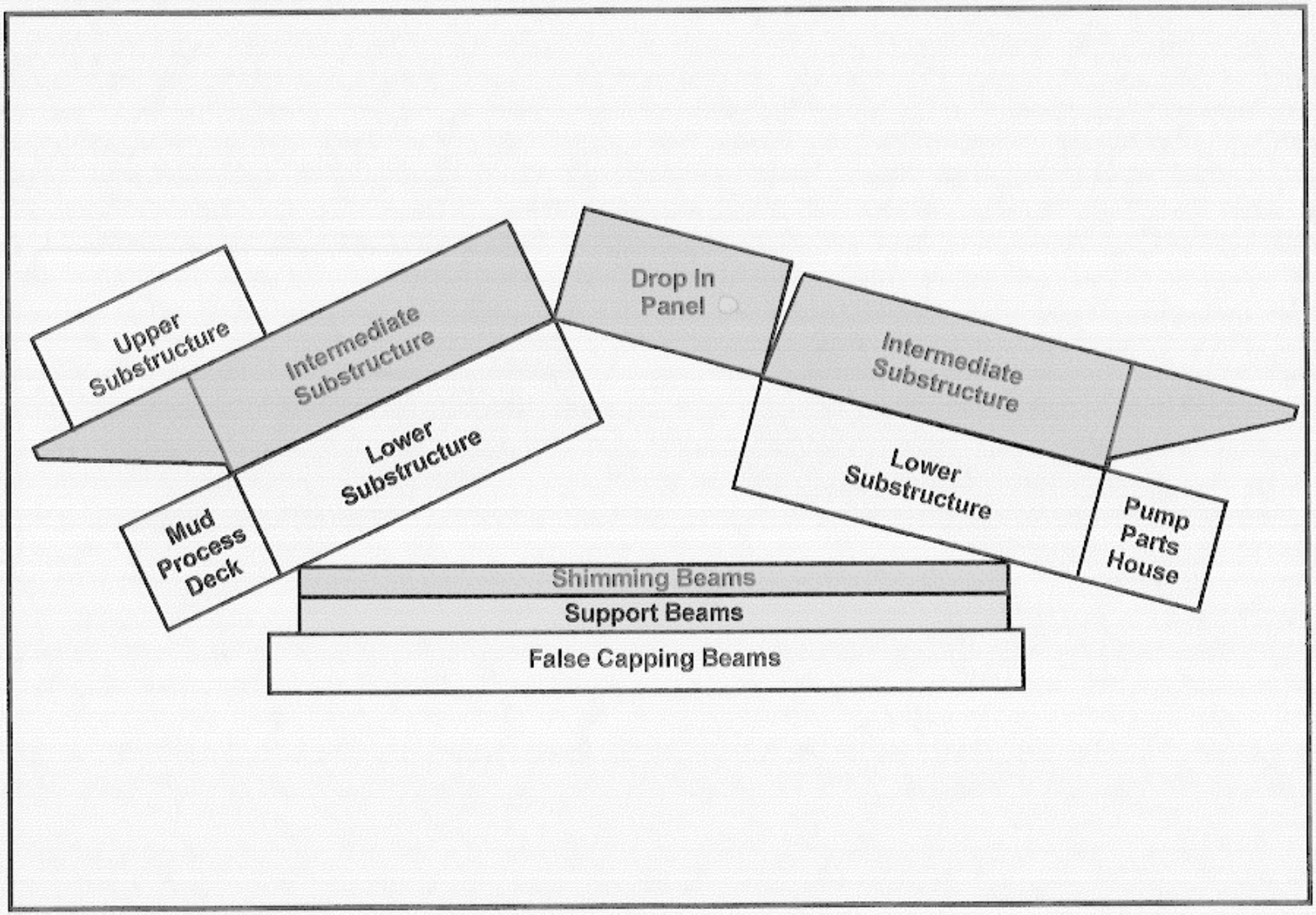
Drawing of Rig 269 Indicating Modifications.

Attachment 3



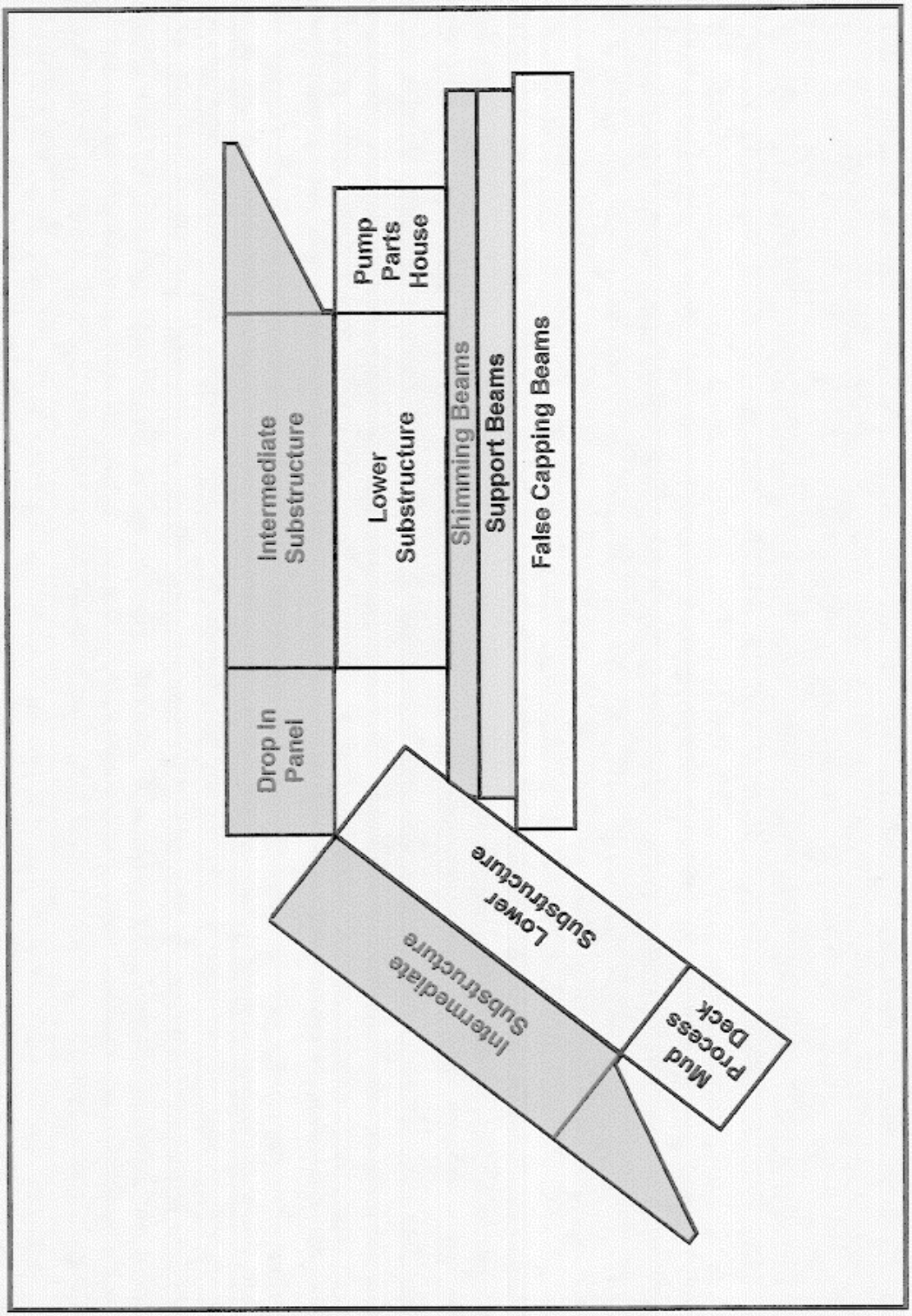
Schematic of Rig 270's Transverse Deployment

Attachment 4



Drawing of Rig 269 in the Initial Stages of Accident

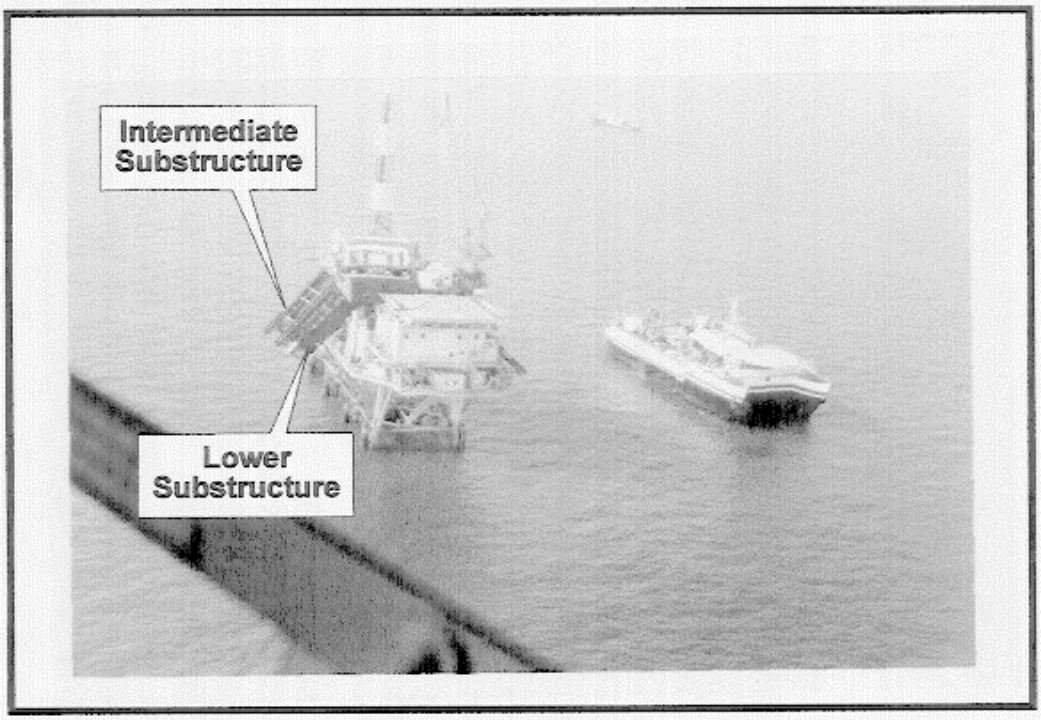
Attachment 5



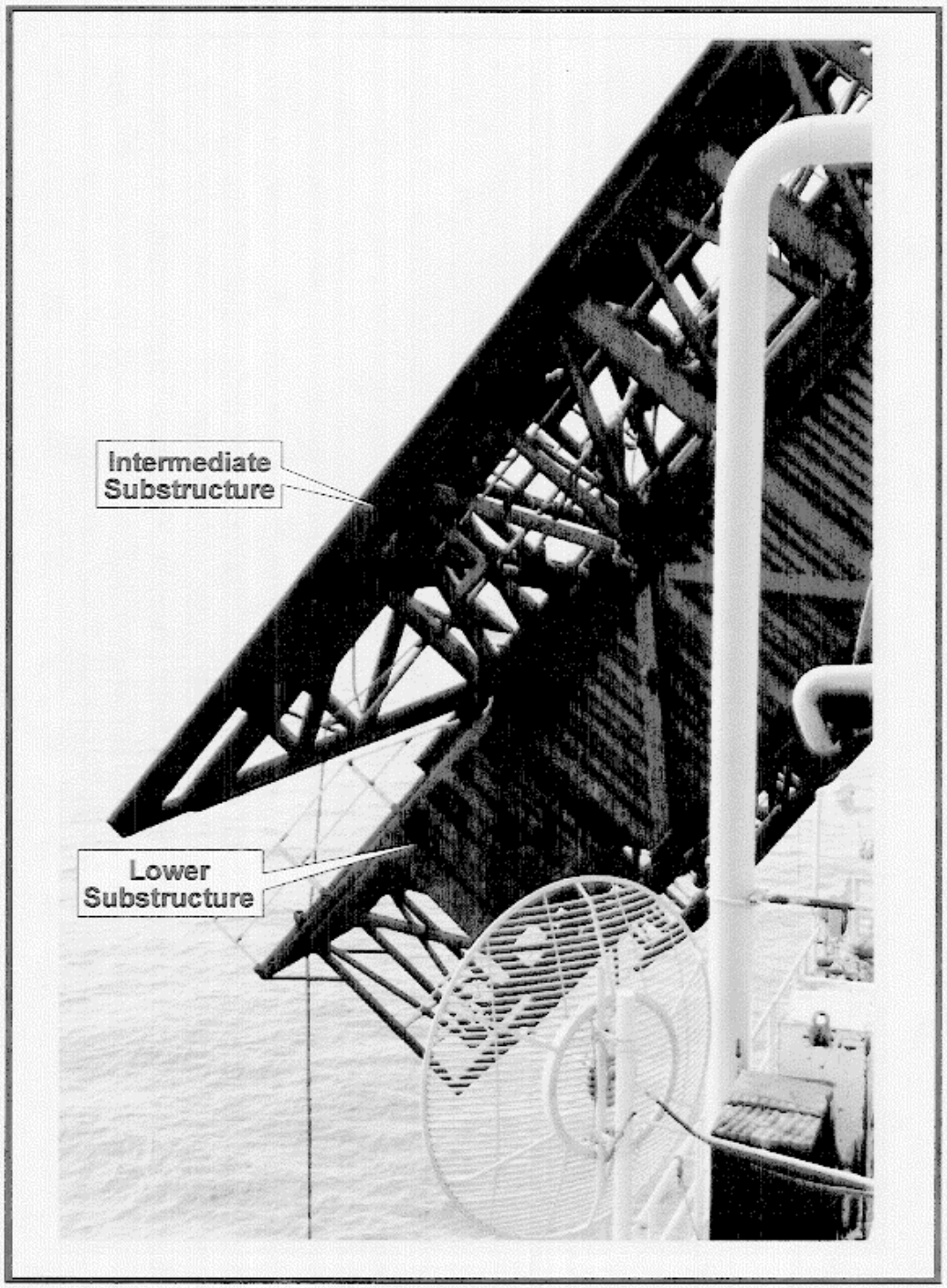
Drawing of Rig 269 at the Conclusion of Accident

Attachment 7

Photographs of Platform B After Accident



Photograph of Platform B After Accident



Photograph of Platform B After Accident

Minerals Management Service
Gulf of Mexico OCS Region

Managing America's offshore energy resources

Protecting America's coastal and marine environments

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.